

(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 1 113 311 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
16.01.2002 Bulletin 2002/03

(51) Int Cl.7: **G02F 1/13363**

(43) Date of publication A2:
04.07.2001 Bulletin 2001/27

(21) Application number: **01106378.1**

(22) Date of filing: **11.06.1998**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **12.06.1997 JP 15543797**
27.08.1997 JP 23098297
27.08.1997 JP 23099197
30.09.1997 JP 26693797
26.12.1997 JP 36138497

(62) Document number(s) of the earlier application(s) in
accordance with Art. 76 EPC:
98304649.1 / 0 884 626

(71) Applicant: **FUJITSU LIMITED**
Kawasaki-shi, Kanagawa 211-8588 (JP)

(72) Inventors:

- **Takeda, Arihiro, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Ohmuro, Katsufumi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Koike, Yoshio, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Kataoka, Shingo, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Sasaki, Takahiro, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Sasabayashi, Takashi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Tsuda, Hideaki, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Chida, Hideo, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Ohashi, Makoto, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Okamoto, Kenji, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Yamaguchi, Hisashi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Otani, Minoru, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)

- **Morishige, Makoto, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Furukawa, Noriaki, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Kamada, Tsuyoshi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Tanaka, Yoshinori, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Hoshino, Atsuyuki, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Hayashi, Shougo, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Takizawa, Hideaki, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Kinjou, Takeshi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Tachibanaki, Makoto, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Imoto, Keiji, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Hasegawa, Tadashi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Yoshida, Hidefumi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Inoue, Hiroyasu, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Taniguchi, Yoji, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Fujikawa, Tetsuya, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Murata, Satoshi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Sawasaki, Manabu, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Hirota, Siro, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Ikeda, Masahiro, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Tashiro, Kunihiro, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Tasaka, Yasutoshi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)
- **Mayama, Takatoshi, Fujitsu Limited**
Kawasaki-shi, Kanagawa 211-8588 (JP)

EP 1 113 311 A3

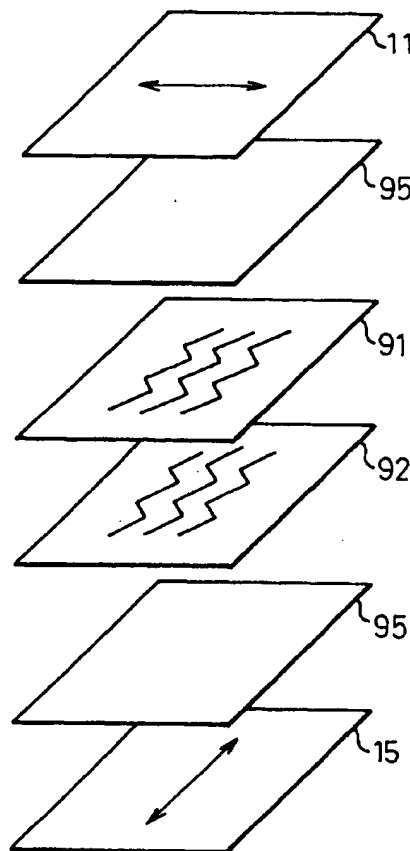
- Tanuma, Seijo, Fujitsu Limited
Kawasaki-shi, Kanagawa 211-8588 (JP)
- Nakanishi, Yohei, Fujitsu Limited
Kawasaki-shi, Kanagawa 211-8588 (JP)
- Tanose, Tomonori, Yonago Fujitsu Limited
Yonago-shi, Tottori 689-3524 (JP)
- Tsukao, Kouji, Yonago Fujitsu Limited
Yonago-shi, Tottori 689-3524 (JP)

(74) Representative: Hitching, Peter Matthew et al
Haseltine Lake & Co., Imperial House, 15-19
Kingsway
London WC2B 6UD (GB)

(54) Vertically-aligned (VA) liquid crystal display device

(57) A liquid crystal display device is provided which comprises a liquid crystal panel in which a liquid crystal having a negative dielectric constant anisotropy is sandwiched between first and second substrates (91, 92), and at least one of said first and second substrates (91, 92) includes domain regulating means for regulating said liquid crystal to be oriented in a plurality of azimuths when a voltage is applied to said liquid crystal. The liquid crystal display device also comprises first and second polarizing plates (11, 15) placed both sides of said liquid crystal panel and at least one phase difference film (95), whose inplane dielectric constants n_x and n_y and dielectric constant n_z in a direction of thickness thereof have the following relation: $n_x, n_y \geq n_z$ (except $n_x = n_y = n_z$), which is placed in at least one of spaces between said liquid crystal panel and one of said first and second polarizing plates (11, 15) and between said liquid crystal panel and the other thereof.

Fig. 225





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 10 6378

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (In.CI.7)
X	OHMURA K ET AL: "33.3: DEVELOPMENT OF SUPER-HIGH-IMAGE-QUALITY VERTICAL-ALIGNMENT-MODE LCD" 1997 SID INTERNATIONAL SYMPOSIUM DIGEST OF TECHNICAL PAPERS. BOSTON, MAY 13 - 15, 1997, SID INTERNATIONAL SYMPOSIUM DIGEST OF TECHNICAL PAPERS, SANTA ANA, SID, US, vol. 28, 13 May 1997 (1997-05-13), pages 845-848, XP000722823 ISSN: 0097-966X * the whole document *	1-6	G02F1/13363
A	ONG H L: "MULTI-DOMAIN HOMEOTROPIC LCDS WITH SUMMETRICAL ANGULAR OPTICAL PERFORMANCE" SID INTERNATIONAL SYMPOSIUM DIGEST OF PAPERS. BOSTON, MAY 17 - 22, 1992, PLAYA DEL REY, SID, US, vol. 23, 17 May 1992 (1992-05-17), pages 405-408, XP000479056 ISSN: 0097-966X Chapter: Results and discussion	1-6	TECHNICAL FIELDS SEARCHED (In.CI.7) G02F
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 03, 29 March 1996 (1996-03-29) -& JP 07 311383 A (SANYO ELECTRIC CO LTD), 28 November 1995 (1995-11-28) * abstract *	1-18	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 November 2001	Examiner Diot, P
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/02 (DocCat)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 01 10 6378

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-11-2001

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 07311383	A	28-11-1995	JP 3005418 B2	31-01-2000

EPO FORM 10469

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82